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## 4 – Utility Design and Management



# 4

## Utility Design and Management

The following chapter is submitted in connection with the Civil Site Plans, entitled “Block 7A”, dated February 18, 2022 as part of this Special Permit with Site Plan Approval (SPSR-A) submission.

For Site Location Map refer to Figure 1.

For existing utilities referenced in this chapter please refer to the drawings in Appendix A entitled:

- Utility As-Built SV-1 thru SV-17 dated November 6, 2014
- Great River Rd Revolution Dr Existing Conditions SV-1 thru SV-4 dated February 8, 2017
- Land Line Park Existing Conditions SV-1 dated April 5, 2018

For proposed utilities referenced in this chapter please refer to the drawings submission entitled:

- Grading, Drainage and Erosion Control Plan, dated February 18, 2022
- Utility Plan, dated February 18, 2022.

### 4.1 Study Description

This analysis confirms and updates findings in a report by Green International Affiliates, Inc., (GIA), which analyzed for the Somerville Office of Housing and Community development (OHCD), all existing utilities, and future improvements within the Assembly Square Revitalization Area (ASRA). The GIA report is entitled “Utility Analysis Report (UAR) for Assembly Square Revitalization Area Somerville, Massachusetts” and was completed in November 2001. The GIA report describes the locations, sizes and capacities of the following existing utility systems: sanitary sewers, water mains, storm-water surface drainage, telephone, gas, electric, cable TV, communication and fire alarms. The OHCD developed a potential build-out scenario in that report for the entire ASRA which was used as the base for the existing utility analyses and to identify the necessary improvements needed to support the potential build-out.

This chapter confirms the existing utility findings in the GIA Report and provides proposed utility connections previously described in the Utility Analysis prepared by

VHB as part of the Assembly Square Amended Preliminary Master Plan (PMP), Planned Unit Development (PUD) submitted to the City of Somerville (the City) in May 2014, which relied upon the Assembly Square Development Utility Analysis confirmed and updated the findings by GIA analyzed for OHCD, all existing utilities, and future improvements within the ASRA.

This chapter was prepared using information in the 2014 AMP-PUD submission and 2001 GIA report. In order to avoid repeated references to the GIA 2001 Utility Analyses, this chapter contains all the utility existing information, data and analyses that are valid for current conditions. Any additional information regarding existing utility information that has been recognized since the previously approved PMP PUD is also reflected in this chapter. This chapter identifies the availability and adequacy of the existing utility facilities and infrastructure that will service Block 7A (the Project). The utility design associated with the Project is consistent with the previously approved Assembly Row Amended PUD-PMP.

## **4.2 Water Supply and Distribution**

The City owns and maintains the public water distribution system that services the ASRA. The City's water distribution system supplies both domestic and fire protection water to the area. The following sections describe the existing and proposed water system surrounding the Site and its capability to service the proposed development.

### **4.2.1 Existing**

The City owns and maintains the public water distribution system that services the Assembly Square Revitalization Area (ASRA). The City's water distribution system supplies both domestic and fire protection water to the area. This system is part of a city-wide interconnected network that is supplied by the Massachusetts Water Resources Authority (MWRA) through seven metered connections. The City is supplied by both MWRA's high service and low service pressure systems. The water distribution system within the Assembly Square area is part of the City's low service system.

MWRA Meter 91 is located at the intersection of the Fellsway West and Middlesex Avenue and provides the closest supply of water to the Assembly Square area from a 48-inch cast iron water main located in Middlesex Fells Parkway (Fellsway). The City does not have any water storage facilities or any pumping stations that service this area.

The MWRA has performed water main improvements to Meter 91 and the existing 48-inch water main located in Middlesex Fells Parkway (Fellsway). The water main

improvements consisted of cleaning, cement-mortar lining, internally sealed joints, 48-inch restrained joint pipe and valving.

The water distribution system surrounding the Project is described as follows:

- The primary connection to the MWRA meter is a 20-inch diameter cast iron main installed in 1925 by the City within and along Middlesex Ave
- Several branch lines of varying diameter feed off the 20-inch main between Middlesex Avenue and the Fellsway
- A 20-inch water main, constructed during earlier phases of the Assembly Row Master Plan, from the existing 20-inch water main in Middlesex Avenue, continues along Grand Union Boulevard to Foley Street then continues west along Foley Street to Middlesex Avenue where the 20-inch water main is looped into the existing 20-inch water main in Middlesex Avenue. The constructed 20-inch main in Foley Street replaced the existing 12-inch water main installed in 1928 as part of the infrastructure improvements for Assembly Row.
- Water mains were extended ranging in size from 8 to 20-inch, from the newly constructed 20-inch water main in Grand Union Boulevard along Artisan Way, Great River Road, Canal Street, Foley Street and Revolution Drive where they are interconnected to create multiple looped systems.
- The remainder of the system along Foley Street, Grand Union Boulevard and Mystic Avenue consist of a 12-inch diameter pipe interconnected to create several loops.
- The City's water mains sizes are all 8-inch diameter and larger which meets the minimum recommended size for adequate fire flows.

## 4.2.2 Required Water Demands

### Projected Water Use

Estimates of water demand have conservatively been determined assuming water use is equivalent to wastewater flows calculated in accordance with Massachusetts Department of Environmental Protection ("MassDEP") Wastewater Design Flows in 314 CMR 15.00. However, these flows are likely to be reduced in recognition of Proponent's commitment to implement water conservation measures and maximizing water efficiency within building during the design development of the Project. In all cases, the City's water distribution system is anticipated to provide sufficient capabilities to meet the normal daily peak demands of the Project.

The projected water consumption rates used to calculate Maximum Projected Water Flow below assume water use to be equivalent to wastewater flows calculated in accordance with the MassDEP Wastewater Design Flow Guidelines in 314 CMR 15.00, generally as follows:

- Office Space: 75 gallons per day per 1,000 square feet

- Lab/Research & Development: 200 gallons per day per 1,000 square feet
- Retail: 50 gallons per day per 1,000 square feet
- Restaurant: 35 gallons/seat

Because the DEP wastewater design flows are considered very conservative in relation to actual flow volumes, no increase in water consumptive rates have been applied to these figures.

**Table 5-1 - Maximum Projected Water Use**

<b>Land Use</b>	<b>Unit – Wastewater Rate (GPD)</b>	<b>Total Size of Building Program</b>	<b>Water Use 100% of Wastewater Rate (GPD)</b>
Office	75/1,000 SF	122,842 SF	9,213
Lab/Research & Development	200/1,000 SF	184,262 SF	36,852
Retail	50/1,000 SF	11,327 SF	566
Restaurant	35/seat	186 seats	6,510
<b>Total</b>			<b>53,141</b>

#### **Fire Flow Demand**

The water system for the Project provides both domestic and fire flow water supply. The City's existing water distribution network within this area has, on average, fire hydrants located 300 feet apart throughout the entire area. This spacing meets the typical maximum recommended distance between hydrants in an urban setting.

The minimum Needed Fire Flow ("NFF") for MWRA Meter 91 and maximum Insurance Services Office ("ISO") requirements for a Community are:

#### Fire Flowrate

Estimated minimum NFF requirements  
to be supplied by MWRA for meter 91: 2,000 gallons per minute (gpm)

Maximum requirements a community is  
required to supply according to the ISO: 3,500 gpm

The required minimum residual pressure at any location within the distribution system during a fire flow situation is 20 psi.

### **4.2.3 Proposed Water**

The following proposed water connections will be installed to service the Project. All proposed water connections are to constructed water mains previously approved in order to provide loop connections throughout the Assembly Square PUD area.

- Connect a new 12-inch water line from the existing 20-inch water main in Foley Street, continued along the proposed alleyway, and looping to the existing 20-inch water main in Revolution Drive. Tapping sleeves and valves are proposed to make the connections to the existing 20-inch water mains.
- 8-inch fire and 6-inch domestic service connections to the proposed 12-inch water line on the west side of the proposed building. Each proposed service will have isolation water gate valves located on the service and on the 12-inch line.
- 12-inch service connections to the proposed 12-inch water line to provide water connections for the future Block 7B/C. Isolation water gate valves are proposed on the service lines and on the 12-inch water line.

### **4.3 Sanitary Sewer**

The City of Somerville owns and maintains the sanitary sewer system in the ASRA. The sanitary sewer is a separated system with storm drainage collected in an independent system. The following sections describe the existing and proposed sewer system surrounding the Site and its capability to service the proposed development.

#### **4.3.1 Existing**

The City of Somerville owns and maintains the sanitary sewer system in the ASRA area. The sanitary sewer system within the area is a separated system with storm drainage collected in an independent system.

All of the master planned sanitary sewer mains have been installed in the ASRA. The pipe starts as an 8-inch at the north end of Assembly Square. The pipe sizes increase to an 18-inch as they discharge towards the southern end of Assembly Square. The reconfigured and reconstructed sewer system in N. Union Street connects to a 24" pipe prior to discharging to the City of Somerville Regulator Manhole, which is the connection to the MWRA system.

In Revolution Drive, there is an existing 10-inch sanitary sewer main that flows east to west, with available stubs to Block 7. On Foley Street, there is an existing 12-inch sewer main that flows east to west with available stubs to Block 7. On Assembly Row, there is an existing 8-inch sanitary sewer main that runs north to south. This sanitary sewer main services Assembly Line Park.

#### **4.3.2 Proposed**

All of the sewer mains in the ASRA have been constructed as part of the previous construction phases of the project. All of the improvements have been consistent with the Preliminary Master Plan and PUD approval processes. The total amount of sewer flow from the Project is essentially unchanged. The distribution of the sewer

flow to the system is also basically unchanged. The sewer system has adequate capacity to handle the sewer flows from the Project as proposed.

The average daily wastewater flow rates are based on MassDEP, Septic Systems ("Title 5"), regulation 314 CMR 15.00. The proposed land use areas and calculated flow rates are shown on Figure 4.1. The sanitary sewer flow rates have been updated with the latest existing and proposed building program for Assembly Square, including the Project's proposed uses.

The Project proposes sanitary sewer connections to the existing sanitary sewer stubs on Revolution Drive and Foley Street, as well as new connections on the same streets to service the various uses of the Project. The wastewater that will flow through the proposed sanitary sewer connections on Foley Street and Revolution Drive will ultimately connect to the Grand Union Boulevard sewer trunk line that flows southerly within Grand Union Boulevard to a 3'-3" by 3'-11" MWRA sewer interceptor near North Union Street. The MWRA interceptor conveys flow to the Charlestown Pumping Station and eventually to the Deer Island Treatment Plant. All of XMBLY, including the Project, will increase wastewater flows to the MWRA interceptor sewer.

#### **4.3.3 Sewer Mitigation**

The Project has received two Sewer Extension and Connection Permits from DEP for discharging into the municipal and MWRA collection system. The first permit was approved on October 8, 2009 (Permit No. X229252) and included details of the sewer mitigation plan. Mitigation to offset flows is required to be implemented as part of the conditions for granting the connection. The mitigation program has been approved by the reviewing agencies. The second permit dated November 10, 2011 (Permit No. X239330) was for the connection of additional flow from a new phase of the development consistent with the master plan. A sewer permit application for the remaining flows from the entire Assembly Square has been reviewed and approved by the City of Somerville Engineering and DPW departments. The proposed mitigation for the entire Assembly Square has remained unchanged.

The mitigation took measures to reduce and/or eliminate non-sanitary sewerage flows, including the completed sewer improvements in Grand Union Boulevard, the completed improvements in Foley Street and Mystic Avenue, off-site improvements completed in the Ten Hills neighborhood, removal of illicitly-connected catch basins on Mystic Avenue, Lombardi Street and Broadway, reduction of flows into the Somerville Marginal Conduit and a financial contribution to the City of Somerville in the form of funds specifically designated for I/I improvements.

The specific inflows and infiltration to be removed from the system that were previously reported are as follows:



**Total Build Out (District A-1 and B-1 minus Yacht Club)**

Proposed Project Added Total Sewer Flows = 777,116 gpd

Minus Existing Redeveloped Areas within District B-1 = 30,361 gpd

Proposed Net Increase in Sewer Flows= 746,755 gpd

Required DEP 4:1 Mitigation= 2,987,020 gpd

**Proposed Mitigation @4:1 (Completed)**

- The Proponent has constructed improvements in the Ten Hills Area including sewer main replacement, sewer manhole replacement and pipe lining to complete the Sewer Inflow and Infiltration mitigation requirements for 610,000 gallons.
- Infiltration into the existing vitrified clay sewer pipes within the entire PUD area has been eliminated with the installation of approximately 1,800 feet of new 18-inch sewer pipes and 3,400 feet of 12-inch sewer pipes. Flow metering of existing pipes determined the potential for elimination of 78,000 gallons per day. The conditions of the sewer extension permit require future flow monitoring to determine if this volume reduction has been achieved.
- Disconnection of illicitly-connected catch basins on Mystic Avenue, Lombardi Street and Broadway that will remove approximately 294,000 gallons per day has been completed.
- Approximately 1,200,000 gallons per day will be removed from the Somerville Marginal Conduit by stormwater improvements in the PUD.
- The Proponent has made a financial contribution to the City specifically designated for Infiltration/Inflow removal projects, offsetting 810,000 gpd of new sewer flows.

**Summary:**

Proposed Project Total Sewer Flows = 777,116 gpd

Required Mitigation = 2,987,020 gpd

<u>Mitigation Description</u>	<u>Sewer Flows</u>
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Ten Hills Area =	610,000 gpd
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I/I reduction from existing PUD sewers =	56,000 gpd
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Illicitly Connected CB disconnection =	73,553 gpd
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Removal of flows from SMC =	1,200,000 gpd
<u>Financial Contribution offset =</u>	<u>1,047,467 gpd</u>
<b>Total = 2,987,020 gpd</b>	

## **4.4 Stormwater**

### **4.4.1 Existing Drainage Conditions**

The majority of the Site is a surface parking lot servicing the surrounding blocks. The existing Site contains one temporary rain garden providing water quality to the surface parking lot. The Site also has temporary public amenity spaces. The Site is generally flat, ranging from approximate elevation 10 feet (NGVD) to 12 feet (NGVD) with the exception of the bioretention basins on the eastern and western edges of the Site where the elevation slopes down to elevation 9 feet (NGVD). The majority of the Site is covered by impervious or near-impervious surfaces. NRCS Soil Maps for Middlesex County (see Figure 2) show the existing soils to be Urban land with wet substratum (603) and Udorthents with wet substratum (655). Geotechnical information available at the time of this chapter classifies the soils as hydrologic soils group D, which has low infiltration potential. The cover condition and soils present in the Site result in minimal infiltration of stormwater. Under existing conditions, stormwater runoff sheet flows over the existing surface parking lot towards the two existing rain gardens. The stormwater runoff is filtered through the lined basins and is collected in a series of underdrains and overflow outlet control structures. The runoff is then conveyed through a closed pipe network in Foley Street to the dedicated 72-inch drainage outfall, which discharges downstream of the Amelia Earhart Dam. The 72-inch outfall was constructed as part of the previous Assembly Square improvements, to redirect stormwater flows from the MWRA 84-inch Somerville Marginal Conduit (SMC) and to help alleviate the potential for combined sewer overflows (CSO) into the Mystic River. The existing 84-inch SMC discharges downstream of the Amelia Earhart Dam to the tidally influenced portion of the Mystic River.

### **4.4.2 Proposed Stormwater Management System**

The Project is designed to comply to the maximum extent practicable with the Massachusetts Stormwater Management Standards for a re-development project and the applicable City of Somerville requirements. The Proponent constructed improvements to existing roadways, construction of new roadways and drives, expansion of the DCR waterfront park and the expansion and upgrade of underground utility infrastructure. The previously constructed stormwater improvements mitigated flow, provided water quality, and protected surrounding

natural resources, as previously described in the Amended PUD-PMP. The Project continues the stormwater design intent of Assembly Square by mitigating flows and providing water quality.

Goals for the Project's proposed drainage system include the following:

- Incorporate LID techniques into the design to the maximum extent practicable.
- Design systems for long-term efficiency by providing concise operation and maintenance requirements.
- Improve the water quality of runoff for the proposed redevelopment areas.

The Project maintains the existing hydrologic conditions and corresponding drainage subwatersheds. The stormwater runoff generated by the Site will be collected via roof drains and a series of trench drains and catch basins with deep sumps and oil/debris traps in the proposed alleyway and conveyed through a closed pipe network connecting to the existing drainage network in Revolution Drive and Foley Street, prior to discharging to the 72-inch outfall at the Mystic River. The repurposed surface parking lot will sheet flow to the western existing rain garden to receive water quality treatment prior to connecting to the existing drainage infrastructure in Foley Street.

Regular sweeping programs for roads, parking and loading areas and a scheduled catch basin cleaning program are proposed for pollutant source reduction. Low Impact Design (LID) stormwater management techniques have been incorporated into the design as much as possible for stormwater quality and temperature control. Water quality is provided via proposed proprietary separators located in the proposed alleyway. The repurposed surface parking lot will receive water quality treatment via the existing rain garden on the western and southern edge of the Site.

A Long-Term Operations and Maintenance (O&M) Plan has already been prepared for Assembly Square and was included in the Amended PUD Assembly on the Mystic Stormwater Report, dated February 2009. The O&M Plan provided detailed procedures and a schedule for maintaining each of the best management practices (BMPs), including the proposed structural water quality devices.

Any oil and grit in the runoff from the structured parking garage will be captured in structured separators prior to discharge to the sanitary sewer system rather than the stormwater closed pipe drainage system. Stormwater runoff from the small amount of proposed on-street parking, in addition to street sweeping and deep sump catch basins, will be treated by specific structural stormwater BMPs that are located in Revolution Drive, that were designed and constructed to provide at least 80 percent total suspended solids (TSS) removal in accordance with the Massachusetts Stormwater Management Regulations. Other BMPs and LID features that may be used throughout the Project include green roofs, permeable asphalt, and permeable

pavers. The use of structured water quality units, planters, and reducing the vehicular accessible impervious surfaces is consistent with past Assembly Square blocks and the Master Plan stormwater management design.

Refer to the Grading, Drainage, and Erosion Control Plan in Appendix A for the proposed drainage infrastructure servicing the Project. Further information on stormwater runoff mitigation can be found in Chapter 5, Stormwater Management Summary.

LID techniques combine functional site design with pollution prevention in order to reduce impacts to nearby water resources. LID can be very effective for new and ultra urban areas, where space is a limiting factor, by selecting LID practices that focus on decentralizing stormwater management at the Site and incorporating vegetated stormwater management techniques into the design as much as possible to reduce peak runoff rates and provide treatment to improve water quality. The practices that have been implemented at Assembly Square include: green roofs, bioretention basins (rain gardens), biofiltration islands, permeable pavers, and rainwater recovery. In addition to improving water quality, these LID practices reduce the temperature of the stormwater discharging at the proposed 72-inch outfall. In addition, raising the roadway of Assembly Row to be a flush condition between the Site and Assembly Line Park, including the replacement of the existing roadway pavement with pavers, will be performed as an ancillary part of the Project.

The Project will include mitigation measures to safely protect surrounding resource areas from the discharge of runoff. The stormwater management system has been designed to meet or exceed the standards contained in the MassDEP Stormwater Management Standards.

In addition to the previously constructed 72-inch stormwater outfall, Assembly Square features multiple LID measures and over two and half miles of stormwater drainage infrastructure that included the replacement of aged existing drainage systems where necessary.

Over 3 million gallons of combined sewer overflows from the MWRA 84-inch SMC entered the Mystic River during wet weather events in 2006. Stormwater runoff entering the MWRA 84-inch SMC from the Assembly Square was redirected to the 72-inch outfall and reduced the amount of CSOs to the Mystic River. The MWRA had performed an analysis of the benefits of removing the flows from the SMC. The analysis showed that removal of flows reduces the average annual treated CSO volume at Outfall MWR205A located near the Fellsway by Wellington Bridge from 2.35 million gallons to 1.70 million gallons, a 28% reduction in annual discharge volume. Outfall MWR205A discharges treated combined sewer flows to the upstream portion of the Mystic River during high tide and extreme wet weather events. A

reduction of discharges in this location presents a direct environmental benefit by improving the water quality of the Mystic River.

The Proponent has entered into a long term maintenance agreement with the City of Somerville to provide for the Proponent's commitments to the City in order to maintain sidewalks within the Project and to maintain the non-standard stormwater quality structures. The City will be responsible for the maintenance of the streets, sewer, water and standard drainage structures (e.g. catch basins, manholes, pipes). The Proponent will maintain the streetscape and plaza landscaping within the Site as part of its responsibilities under the long-term maintenance agreement.

## 4.5 Private Utilities

The follow sections describe the existing and proposed private utilities surrounding the Block 7A Assembly PUD-PMP Site:

### 4.5.1 Gas

#### Existing System

Gas services to the Site are provided by National Grid. The existing gas lines surrounding the Site are as follows:

- 16 to 20-inch welded steel gas line located in an easement which runs across the MBTA tracks near Grand Union Boulevard and North Union Street
- Other gas lines within the area branch off the 20-inch line, including a 12-inch gas line in Revolution Drive and an 8-inch gas line in Foley Street
- The nearest source of the higher pressure gas to the Project is located in Pinckney Street in East Somerville. A 12-inch steel gas line was installed from Pinckney Street to the Project along Pearl Street, Mt. Vernon Street, Lombardi, and Grand Union Boulevard. The gas line mains have been installed into the Assembly Square area for connection to the future blocks.

#### Proposed System

The Project proposes to connect directly into the existing gas mains in Foley Street and Revolution Drive. Refer to Utility Plan in Appendix A for potential gas connections for the Project.

### 4.5.2 Electrical

There are several existing electric duct banks and manholes surrounding the Site in Foley Street and Revolution Drive. Eversource provides the electricity for the ASRA.

Electric conduits run north-south on the northern side of Revolution Drive, with an electric manhole ("EMH") at the intersection of Assembly Row and Revolution Drive

intersection. This EMH can be utilized as a potential connection point for the Project as it is further developed. There is an existing EMH on the southern side of Foley Street at the northern end of the proposed alleyway. The Project proposes to connect to the existing EMH in Foley Street and run a new electric ductbank north to south down the proposed alleyway to service the Project.

The design of the proposed conduit system and electric demands of the Project will be coordinated with Eversource to accommodate the Project's required electrical infrastructure.

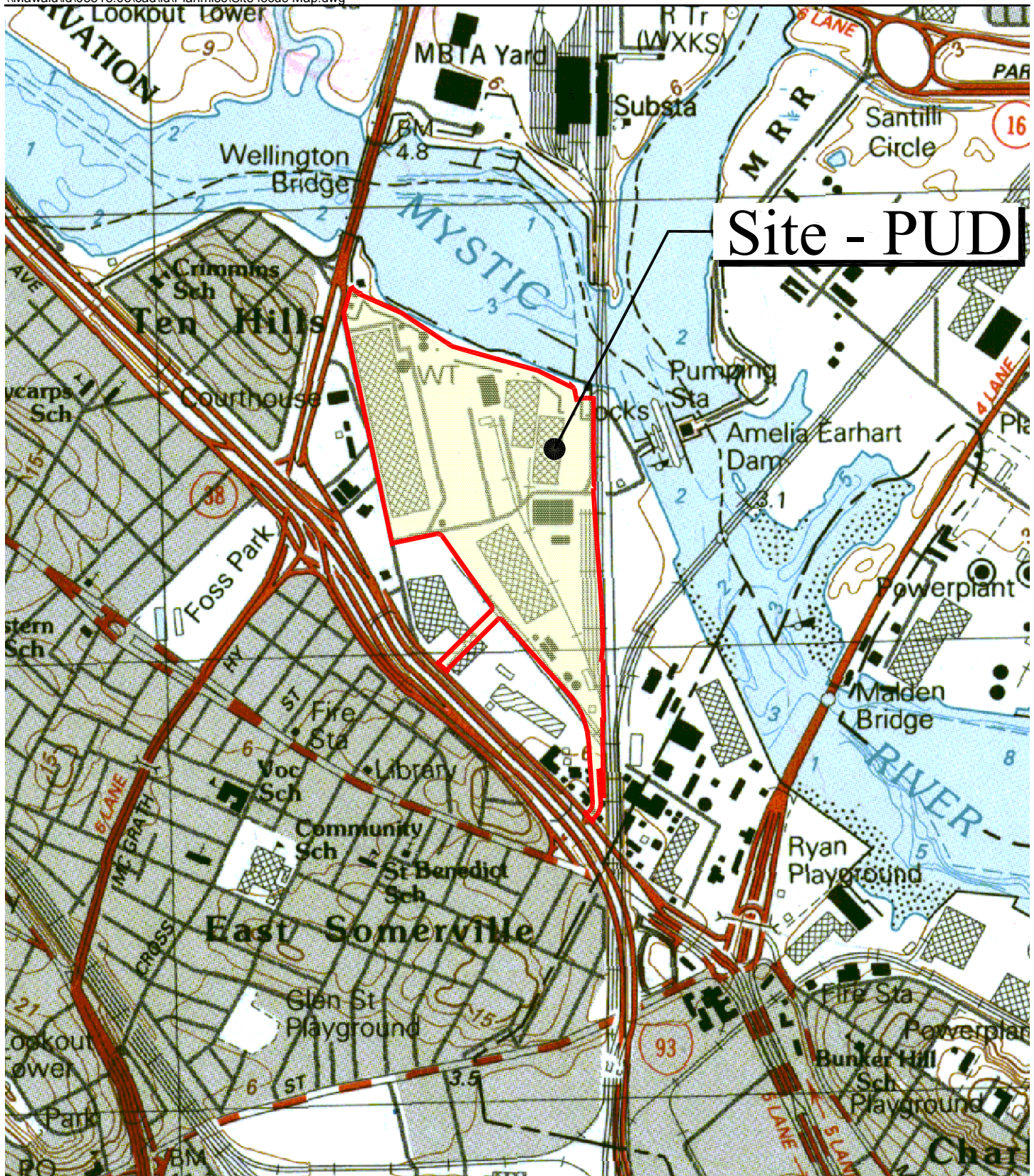
#### **4.5.3 Telephone Communications, Fire Alarm, and Cable**

Verizon, Comcast, and RCN provide telephone communication and services to the Site. The system consists solely of underground duct banks. Telecom conduits are located along Revolution Drive and Foley Street, including combined telecom manholes ("TMH") for Comcast, RCN, and Federal Realty owned house conduits, and separate TMHs for Verizon. A pair of these manholes are located just north of the Site on Foley Street. A single Verizon TMH is located in the southern side of Revolution Drive, adjacent to the Mass General Brigham site.

The Project proposes new telecom connections for RCN, Comcast, and Verizon conduits to provide service to the proposed building. The Project proposes a Verizon telecom connection to the existing TMH in Revolution Drive and combined Comcast, RCN, and Federal Realty connections to the existing shared TMH in Foley Street. The Project will connect directly into the existing TMHs and not utilize the existing telecom stubs on Foley Street. These existing telecom stubs will be trimmed back as necessary to accommodate the proposed landscape design.

The Project's proposed conduit system will be coordinated with Verizon, Comcast, and RCN to accommodate the required telephone communication infrastructure.





Site - PUD

Vanasse Hangen Brustlin, Inc.

Figure 1  
July 2010



0 500 1000 Feet

Site Location Map  
Assembly Row  
at Assembly Square  
Amended Preliminary Master Plan  
Planned Unit Development  
Somerville, MA







**Vanasse Hangen Brustlin, Inc.**  
Consulting Engineers and Planners  
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#### Figure 4.1 - Development Program

Project: Assembly Square Planned Unit Development  
Full Build Sewer Generation - 2021 Block 7A SPSR Program  
**Current Build Program As-Built and Leased**  
Location: Somerville, Massachusetts

Proj. No.: 08518.23  
Date: Feb. 2022  
Computed by: PTM  
Checked by: DAH

				Development Program and Projected Sewer Flows							
Phase	Block	Comments <sup>1</sup>	Use <sup>2</sup>	Area <sup>3</sup> (SF)	Unit	Quantity	Unit Flow <sup>4</sup> (Gal/Unit)	Average Flow (GPD)	Total Block Flow (GPD)	Total Phase Flow (GPD)	
1AA	10	4,391	Retail	2,300	1,000 SF	2	50	115	1,960	1,960	
			Fast Food	2,091	1 Seat	98	20	1,960			
1A	1	66,569	Retail	38,292	1,000 SF	38	50	1,915	67,134	161,350	
			Residential	225,615	1 Bedroom	293	110	32,230			
				Dwelling Units	195						
			Restaurant	28,277	1 Seat	943	35	32,990	25,581		
	2	32,281	Retail	16,605	1,000 SF	17	50	830			
			Office	93,183	1,000 SF	93	75	6,989			
			Fast Food	4,703	1 Seat	188	20	3,762			
			Restaurant	10,973	1 Seat	400	35	14,000			18,586
	3	178,309	Retail	107,715	1,000 SF	108	50	5,386			
			Cinema	62,557	1 Seat	1,590	5	7,950			
				Lego Land (incl in retail)	0						
			Fast Food	0	1 Seat	0	20	0	48,509		
	4	39,048	Retail	38,462	1,000 SF	38	50	1,923			
			Residential	249,964	1 Bedroom	389	110	42,790			
				Dwelling Units	253						
			Fast Food	586	1 Seat	23	20	469	1,540		
			Restaurant	1,269	1 Seat	150	35	5,250			
	KIOSK		3,605	Fast Food	3,605	1 Seat	77	20	1,540		
2	5A	20,953	Retail	14,988	1,000 SF	15	50	749	45,554	249,881	
				Condo	182,404	1 Bedroom	186	110			20,460
					Dwelling Units	122					
				Hotel	100,056	1 Bedroom	158	110			17,380
				Fast Food	0	1 Seat	0	20			0
	6		Restaurant	5,965	1 Seat	199	35	6,965	79,944		
		28,369	Retail	20,149	1,000 SF	20	50	1,007			
				Residential	603,017	1 Bedroom	624	110			68,640
					Dwelling Units	447					
				Medical Office	9,414	1,000 SF	9	75			706
			Fast Food	0	1 Seat	0	20	0	117,545		
			Restaurant	8,220	1 Seat	274	35	9,590			
	11A	70,449	Retail	15,221	1,000 SF	15	50	761			
			Office	789,750	1,000 SF	790	75	59,231			
			Day Care	--	per person	171	10	1,710			
			Medical Office	8,000	1,000 SF	8	75	600			
			Fast Food	8,967	1 Seat	359	20	7,174			
			Restaurant	8,149	1 Seat	272	35	9,507			
			Lucky Strike - Restaurant	29,612	1 Seat	987	35	34,547			
			Lucky Strike - Bowling/Arcade	6,500	1 Lane	8	100	800			
			Health Club	16,072	1 Locker	161	20	3,214			1,600
KIOSK	2,000	Fast Food	2,000	1 Seat	80	20	1,600				
KIOSK	4,490	Restaurant	4,490	1 Seat	150	35	5,238	5,238			

3	5B	26,614	Retail	18,665	1,000 SF	19	50	933	29,260	118,345
			Office	292,890	1,000 SF	293	75	21,967		
			Fast Food	7,949	1 Seat	318	20	6,360		
			Restaurant	0	1 Seat	0	35	0		
	8	26,500	Retail	13,000	1,000 SF	13	50	650	89,085	
			Residential	496,267	1 Bedroom	684	110	75,240		
				Dwelling Units	500					
			Fast Food	7,000	1 Seat	280	20	5,600		
		Restaurant	6,500	1 Seat	217	35	7,595			
	Full Build Remaining Phases	7A	16,906	Retail	11,327	1,000 SF	11	50	566	
			Office	122,842	1,000 SF	123	75	9,213		
			Lab/R&D	184,262	1,000 SF	184	200	36,852		
			Restaurant	5,579	1 Seat	186	35	6,510		
7B & 7C		30,600	Retail	12,100	1,000 SF	12	50	605	63,655	
			Office	570,000	1,000 SF	570	75	42,750		
			Fast Food	3,500	1 Seat	140	20	2,800		
			Restaurant	15,000	1 Seat	500	35	17,500		
9		8,930	Retail	8,930	1,000 SF	9	50	447	25,029	
			Office	327,770	1,000 SF	328	75	24,583		
11B		Office	300,000	1,000 SF	300	75	22,500	22,500		
				5,128,489				697,786	FULL BUILD TOTAL	695,863

**Notes:**

- 1) Retail was space allocated at by 20.3% for estimated restaurant areas and by 6.0% for fast food within all future Blocks. Future Phase Building Program info taken from Street-Works LLC Proposed Phasing Schedule dated 2/13/09. Total restaurant area - 121,701 square feet (includes Block 10 and IKEA).
- 2) Restaurant seats are based on 30 square feet per seat within future phases.
- 3) Average flows for Massachusetts are based on 310 CMR 15: Title V.
- 4) Not used.

# National Flood Hazard Layer FIRMette



71°5'8"W 42°23'50"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000  
Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 10/21/2021 at 10:57 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Figure 4.3





# Soil Map—Middlesex County, Massachusetts



Figure 4.4 - NRCS Soil Map



## MAP LEGEND

### Area of Interest (AOI)

 Area of Interest (AOI)

### Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

### Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

### Water Features



Streams and Canals

### Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

### Background



Aerial Photography

## MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:25,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Middlesex County, Massachusetts

Survey Area Data: Version 21, Sep 2, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 13, 2020—Oct 18, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

## Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
603	Urban land, wet substratum	23.3	74.2%
655	Udorthents, wet substratum	8.1	25.8%
<b>Totals for Area of Interest</b>		<b>31.4</b>	<b>100.0%</b>

